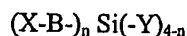


Claims

1. Hardener for curing of epoxy resins which produces materials with high abrasion resistance, photostability and chemical resistance, **characterized in that** the hardener comprises a sol
5 prepared by controlled hydrolysis and condensation of compounds of the type:



- where $n = 1$ or 2 , $X = SH$, $-N=C=O$, or NR_1R_2 , R_1 , R_2 being chosen from hydrogen, saturated or
10 unsaturated C_1 - C_{18} -alkyl, substituted or non-substituted aryl, formyl, aliphatic or aromatic
carbonyl, carbamoyl, sulphonyl, sulfoxyl, phosphonyl, sulphinyl, phosphinyl, while the carbon
chains of said compounds may include one or more of the elements oxygen, nitrogen, sulphur,
phosphorus, silicon and boron, and/or may include one or more hydrolysable silane units or R_1 , R_2
are chosen from condensation products or addition products of one or more types or chemical
15 compounds such as acids, alcohols, phenols, amines, aldehydes or epoxides, and
 B is a spacing group chosen from saturated or unsaturated C_1 - C_{18} -alkylene, substituted or non-
substituted arylene, while the carbon chains of the stated compounds may include one or more of
the elements oxygen, nitrogen, sulphur, phosphorus, silicon and boron and Y is chosen from
hydrolysable groups such as alkoxy, carboxyl, and halogen.

20

2. Hardener as claimed in claim 1,
characterized in that the hardener also comprises at least one UV-absorber.
3. Hardener as claimed in one of the preceding claims,
25 **characterized in that** the hardener also comprises at least one free radical scavenger.
4. Hardener as claimed in one of the preceding claims,
characterized in that the hardener also comprises at least one antioxidant.
- 30 5. Hardener as claimed in one of the preceding claims,
characterized in that the hardener also comprises at least one dye and/or pigment.
6. Hardener as claimed in one of the preceding claims,
characterized in that the hardener also comprises at least one filler.
- 35 7. Hardener as claimed in one of the preceding claims,
characterized in that the hardener also comprises at least one additive.

8. Hardener as claimed in one of the claims 1-7,
characterized in that $X = NR_1R_2$, R_1 is hydrogen and R_2 is $H-(HN-CH_2-CH_2-)_m$ where $m = 0-6$, B is propylene, $n = 1$, and Y is an ethoxy or methoxy.
- 5
9. Hardener as claimed in one of the claims 1-7,
characterized in that $X = NR_1R_2$, R_1 is hydrogen and R_2 is phenyl, B is propylene, $n = 1$, and Y is ethoxy or methoxy.
- 10
10. Hardener as claimed in one of the claims 1-7,
characterized in that $X = NR_1R_2$, R_1 is hydrogen and R_2 is carbamoyl, B is propylene, $n = 1$, and Y is ethoxy or methoxy.
11. Hardener as claimed in one of the claims 1-7,
- 15 **characterized in that** $X = SH$, B is propylene, $n = 1$, and Y is ethoxy or methoxy.
12. Hardener as claimed in one of the claims 1-7,
characterized in that $X = -N=C=O$, B is propylene, $n = 1$, and Y is ethoxy or methoxy.
- 20
13. Hardener as claimed in one of the claims 1-7,
characterized in that the sol is prepared entirely or partly by controlled hydrolysis and condensation of bis (γ -trialkoxysilylpropyl)amine.
14. Hardener as claimed in one of the claims 1-7,
- 25 **characterized in that** the sol is prepared entirely or partly by controlled hydrolysis and condensation of tri[3-(trialkoxysilylpropyl)]isocyanurate.
15. Hardener as claimed in claim 1,
characterized in that more or less free amino groups at the surface of the particle-forming
- 30 condensation product in the sol has been entirely or partly converted with reactive compounds such as epoxides, acid derivatives, blocked and non-blocked isocyanates and compounds of the type R-X where X is a suitable atom or atom group that may be replaced and R is an organic residue or a fraction of such residue.
- 35
16. Hardener as claimed in claim 15,
characterized in that X is chosen among halogen, substituted or non-substituted alkoxyl, phenoxy, amine, carboxylate, sulphonate, sulphinate, phosphonate and phosphinate.

17. Hardener as claimed in claim 15,
characterized in that R is chosen among non-substituted saturated and unsaturated C₁-C₂₄ alkyl, substituted saturated or unsaturated C₁-C₂₄ alkyl, substituted or non-substituted aryl, aliphatic or aromatic carbonyl, wherein the carbon chains of said compounds may optionally include one or more of the elements nitrogen, sulphur, silicon and boron and groups chosen among condensation products of one or more type of chemical compounds such as acids, alcohols, phenols, amines, aldehydes and epoxides.
- 10 18. Cured epoxy material,
characterized in that it is manufactured from an epoxy resin and a hardener as defined by claim 1.
19. Method for curing epoxy resins,
characterized in
- 15 i) producing a stable sol by controlled hydrolysis and condensation of a silane compound of the formula:
- $$(X-B)_n Si(-Y)_{4-n}$$
- 20 where n = 1 or 2, X = SH, -N=C=O, or NR₁R₂, R₁, R₂ being chosen from hydrogen, saturated or unsaturated C₁-C₁₈-alkyl, substituted or non-substituted aryl, formyl, aliphatic or aromatic carbonyl, carbamoyl, sulphonyl, sulfoxyl, phosphonyl, sulphinyl and phosphinyl, while the carbon chains of said compounds may optionally include one or more of the elements oxygen, nitrogen, sulphur, phosphorus, silicon and boron, and/or may include one or more hydrolysable
- 25 silane units or R₁, R₂ are chosen from condensation products or addition products of one or more types or chemical compounds such as acids, alcohols, phenols, amines, aldehydes or epoxides, said silane compound optionally being a modified one, and that
- ii) the sol, subsequent to possible storage, is mixed with an epoxy resin so that the latter is cured.
- 30 20. Method as claimed in claim 19,
characterized in that unwanted reaction products from step i), such as alcohols and water, are removed from the sol prior to step ii).
21. Utilization of a hardener as defined by any one of the claims 1-17 for curing of epoxy based
35 or isocyanate based resins.